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THE LIFE HISTORY OF THE CREEPING WATER BUG, PELOCORIS CAROLINENSIS BUENO (NAUCORIDAE).

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The above-named bug is the only representative of the family Naucoridae reported for Kansas. It has been taken several times from some pools near Coldwater, Kansas, but has not been found elsewhere in the state. I have previously reported the first collection which consisted of a long series of this insect taken by Mr. Beamer and his entomological survey party on July 28, 1916. They found these insects in a series of spring-fed pools in the bed of an intermittent stream. These pools contained a thick growth of *Nitella* amongst which the bugs were living. Mr. Beamer sent me a large number of living adults and nymphs packed in the stonewort in which they were taken. About all I was able to learn concerning them at that time was that they could and did on every occasion possible "sting" most viciously, much to my sorrow. A sting by a hornet is to be preferred to the thrust of the stylets of one of these creatures. While I was able to keep them under observation for some time they died one by one without the nymphs molting or the adults depositing eggs. Since this was one family of the aquatic Hemiptera concerning the biology of which I had no first-hand knowledge, I made every effort to secure more living material. Inasmuch as Coldwater is located in the southwestern part of the state, over three hundred miles from Lawrence, it was not an easy matter to get the living bugs. Finally, Mr. Clarence O. Bare sent sixty-one specimens on September 7, 1923. These died. In April, 1925, Professor

Beamer and Mr. Bare made an automobile trip into the region and brought me a couple hundred of living adults. This time with abundant material at the proper season I was able to start a large number of rearings. The first eggs were deposited on April 14th. They were attached to a sprig of *Nitella* as shown in the drawing on Plate VI. By the latter part of May other duties made it necessary for me to turn the rearings over to Mr. Robert Guntert, our able field assistant, who by careful attention and ingenuity was able to rear the insects. Each newly hatched insect was placed in a glass Stender dish, the molting dates recorded as they occurred and the exuviae placed in a vial of alcohol. If a nymph died it was placed in the vial so that a great many nymphs and cast skins have been available for study.

On April 18, 1925, I planted a colony of twelve adults in Rock Pool, a temporary rock quarry pool east of Lawrence, Kansas, and on April 22 a similar number in a spring-fed pool on the Country Club grounds. In neither case did the insects survive.

Since these insects are fiercely predacious it was necessary to isolate each newly hatched nymph. Each specimen was placed in a tall Stender dish or jelly glass half-full of water and supplied with a sprig of *Nitella.* Mosquito wrigglers, chironomus larvae, Corixids and Entomostraca were given as food and the water replaced by fresh pond water at frequent intervals. There was something grievously wrong with the rearing technique for we succeeded in rearing to the adult stage only nine specimens from 134 isolations. In the paper on "The Life History of the Toad Bug,"[1] I published the individual records to visualize the large mortality attending that investigation. Herewith I am submitting the data in brief form. Several females were mated and isolated and deposited eggs as follows:

A. Female isolated April 13; laid 9 eggs April 14, 1 on April 15, 1 on April 16, 3 on April 17, 12 on April 25, 4 on April 27 and 14 more by May 14; a total of 44 eggs. She died June 17.

B. Female isolated April 13; laid 11 eggs April 14, 10 on April 17, 11 on April 18, 6 on April 20 and 6 on April 27; a total of 44 eggs in 14 days.

C. Female isolated April 13; laid 12 eggs April 14, 7 eggs April 15, 1 egg April 16, 4 eggs April 17, 7 eggs April 18, 13 eggs April 22 and 7 eggs on April 25. Here was a total of 51 eggs during 12

[1] Hungerford, H. B., The Life History of the Toad Bug, *Gelastocoris oculatus* Fabr. (Gelastocoridae), *Kansas University Science Bulletin,* Vol. XIV, pp. 145–167, 1922.

days. She continued to deposit eggs till May 14, when she was liberated.

D. Female isolated April 13; laid 10 eggs on April 22, 6 more on April 27 and then died.

E. Female isolated April 13; deposited 8 eggs on April 14, 4 eggs April 17, 7 eggs April 18, 3 eggs April 20, 16 eggs April 22, 5 eggs April 25, 10 eggs April 27; a total of 53 eggs in 14 days. Then she was transferred to a larger jar where she continued to deposit eggs for some time.

G. Female isolated April 13; deposited 2 eggs April 16, 2 eggs April 17, 6 eggs April 18, 3 eggs April 20, 8 eggs April 22, 7 eggs April 25 and thereafter laid no more eggs; a total of 28 eggs.

The majority of the eggs recorded above showed red eye spots by May 14. The incubation period varied from 32 to 45 days, with the majority requiring 39 to 40 days, as shown in the table below. By the time the eggs were ready for hatching the plant sprigs to which they were attached were dead and in some cases in a state of disintegration.

LENGTH OF INCUBATION PERIOD BETWEEN APRIL 14TH AND JUNE 5TH
(*Observations on 143 eggs at laboratory temperature*)

Duration in days	32	34	35	36	37	38	39	40	41	42	43	44	45
Number of eggs hatching	2	2	3	3	3	18	31	36	16	15	5	5	4

The majority of the nymphs died in the first instar. The large numbers that succumbed between the fifth and twelfth days would indicate that death might have been due to some difficulties involved in molting. One first instar nymph lived 22 days, but failed to transform. The bugs that passed the first molt successfully did so in from 9 to 14 days. The table below summarizes the records of 134 nymphs.

LENGTH OF FIRST NYMPHAL STADIUM
(*Observations on 134 Nymphs of which only 24 Passed the First Molt Successfully*)

Duration of days..	1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22	Total
Number making successful 1st molt								3	1	6	5	4	4						1		24
Number dying in 1st molt															2						2
Dying still in 1st instar	1	4	4	7	5	9	6	12	15	17	7	5	3	2	3	4	1	1	1	1	108

The time required for development from the hatching of the egg to the emergence of the adult was from 50 to 62 days. The total period from the deposition of the egg to the appearance of the adult was from 88 to 102 days. The length of time required for each stage is shown in the table opposite. In this table it will be noted that two males that hatched in May, 1925, lived until August, 1926.

The Egg.

Size: Length, 1.26 mm.; diameter, .6 mm. Like other Hemipterous eggs I have studied these eggs enlarge as the embryos develop within. By the time the Naucorid embryo is formed and rotating within the shell the length has increased to 1.5 mm. and the diameter to .8 mm.

Shape: The shape of the egg is shown in the drawing on Plate . The micropyle is about .06 mm. in length.

Color: The color of the egg is creamy white when first deposited. As the embryo develops within, the eye spots show first as pink streaks and later as red fully formed eyes.

The eggs are glued to the leaflets and stems of *Nitella* and other aquatic plants by means of a fairly generous quantity of white adhesive.

By means of the drawings on Plate VI and the measurements given below, it will be possible to identify the stages of this insect that may be taken in pond survey work.

	Length	Greatest Width	Width of Head
First instar:	2.7 mm.	1.6 mm.	1 mm.
Second instar:	3.6 mm.	2.2 mm.	1.3 mm.
Third instar:	5.2 mm.	3.2 mm.	1.7 mm.
Fourth instar:	7.1 mm.	4.4 mm.	2.3 mm.
Fifth instar:	9 mm.	5.2 mm.	2.7 mm.

The general appearance of the nymph is the same as that of the parent. The first instar form has a single segmented anterior tarsus which lacks a claw. The middle and posterior tarsi are two segmented, the first segment being very short and asymetrical, the second bearing two claws of about equal length. The middle and hind limbs are sparsely provided with natatory hairs. The antennae are three segmented, the basal segment being very short. The later nymphs agree with the first except that the antennae

RECORD OF NYMPHS THAT SURVIVED ONE OR MORE MOLTS, SEASON OF 1925

No.	Egg Laid	Date Hatch	1st Molt	2nd Molt	3rd Molt	4th Molt	5th Molt	Sex	Days in Nymphal Stages						Remarks
									1st	2nd	3rd	4th	5th	Total	
A1e	April 14	May 21	June 4	June 15	June 25	July 8	July 21	♀	14	11	10	13	13	62	
A1k	April 14	May 24	June 5	June 17	June 24	July 5	July 25	♀	12	12	7	11	20	62	
				Died											
B1c	April 14	May 23	June 5	June 15					13						
B1e	April 14	May 23	June 4	June 18	June 29	?	July 24	♂	12	14	11			62	Mated with A1e Aug. 3
B1g	April 14	May 23	June 6	June 14	June 21	July 3	July 14	♂	14	8	7	12	11	52	Died Aug., 1926
B2a	April 17	May 24	June 7	June 18	June 25	July 5	July 21	♂	14	11	7	10	16	58	
C1a	April 14	May 22	June 4	June 15	June 23	July 6	July 17	♂	13	11	8	13	11	56	
C1g	April 14	May 22	June 5	June 15	June 22				14	10	7				
				Died											
C2b	April 15	May 24	June 6	June 9					13						
				Died											
C2c	April 15	May 28	June 8	June 13					11						
				Died											
C3a	April 16	May 24	June 6	June 9					13						
C5b	April 18	May 28	June 9	June 18	June 26	July 6			12	9	8	10			
C5c	April 18	May 28	June 9	June 23	June 26	July 8	July 23	♀	12	14	3	12	15	56	
				Died											
C5d	April 18	May 28	June 8	June 17					11						
				Died											
C5h	April 18	May 30	June 8	June 12					9						
				Died											
E1g	April 14	May 23	June 4	June 9					12						
				Died											
E3a	April 18	May 28	June 8	June 10					11						
E4a	April 20	May 30	June 9	June 19	June 26	July 5	July 17	♀	10	10	7	9	12	48	
E4c	April 20	May 30	June 8	June 17	June 24	July 6	July 19	♂	9	9	7	12	13	50	
E4d	April 22	May 30	June 12	June 27	July 14				13	15	17				Died Aug., 1926
				Died											
G2a	April 17	May 25	June 7	June 12					13						
G3a	April 18	May 28	June 11	June 21	July 11				14	10	20				
				Died											
G3b	April 18	May 28	June 10	June 15					13						
						Killed									Eaten by Naiad of Dragon Fly
G4f	April 22	May 3	June 12	June 19	June 25	July 1			9	7	6				

show some development of the terminal segment which in the fifth stage have a slight constriction suggesting segmentation. The large mesothoracic spiracles are located on the underside of the body just behind the anterior coxal cavities and show plainly in the later stages. Mr. J. R. de la Torre-Bueno[2] reared two specimens of *Pelocoris femorata* P. B. This species also has five nymphal instars, but came through the various stages in a shorter time than that recorded above for *Pelocoris carolinensis* Bueno. He gives the egg stages as about 24 days and the nymphal period 53 days, while the species I am reporting required about 39 or 40 days for the egg stage and from 50 to 62 days for the nymphal period. Temperature undoubtedly accounts for the difference in the lengths of the incubation period. He began his observations in June while mine were started in April. *Pelocoris femorata* P. B. is a larger insect than *Pelocoris carolinensis* Bueno according to Mr. Torre-Bueno and to be distinguished by the fact that the last ventral abdominal segment of the female is not emarginate. Mr. Torre-Bueno was kind enough to determine the Kansas species.

PLATE VI.—DEVELOPMENT STAGES OF THE CREEPING WATER BUG, *Pelocoris carolinensis* BUENO, BY H. B. HUNGERFORD.

Figure 1. Egg glued to a sprig of water plant.
Figure 2. First instar nymph.
Figure 3. Second instar.
Figure 4. Egg.
Figure 5. Antenna of fifth instar nymph.
Figure 6. Antenna of first instar nymph.
Figure 7. Third instar nymph.
Figure 8. Egg.
Figure 9. Fourth nymphal instar.
Figure 10. Fifth nymphal instar.

Note: Figures 2, 3, 4, 7, 9 and 10 are drawn on same scale. Drawings by Miss Kathleen Doering.

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[2] Torre-Bueno, J. R. de la, Brief Notes Toward the Life History of *Pelocoris femorata* Pal. B. with a Few Remarks on Habits, *Jour. New York Entomological Society,* Vol. XI, pp. 166–173, 1903.